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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/757,694	01/13/2004	Vijay Chowdhury	9818-098-999	4109

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EXAMINER	
PATEL, PARESH H	
ART UNIT	**PAPER NUMBER**
2829	

DATE MAILED: 03/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/757,694	CHOWDHURY ET AL.
	Examiner	Art Unit
	Paresh Patel	2829

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 January 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 13-14 and 1-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Macdonald (US 3631238) in view of Weiner et al. (US 6642726) and Lin et al. (US 6774648).

Regarding claim 13, Macdonald in fig. 1-2 discloses an apparatus for measuring passive voltage contrast on a die [lines 9-19 of column 12], comprising:

a container [18] having a primary electron beam generator [10, 21] and a secondary electron collector [20,22]; and

a sample holder [16] having an adjustable base and a stand on the base [movable 16, see line 36-37 of column 4 and 1-7 of column 8], the stand having an oblique surface [see 16 in fig. 1] for holding a die that faces the primary electron beam generator and the secondary electron collector.

Macdonald is silent about the base being adjustable such that the primary electron beam generator releases an electron beam that is incident upon a location on the die surface **at an angle of at least 75°.**

Macdonald discloses angle of about 45° between the die and the primary beam [see lines 25-28 of column 1] to excite an emission of secondary electrons. Macdonald

also suggests that secondary electron current produced by the primary beam varies with number of factors including die [specimen] geometry. Therefore, the base being adjustable such that the primary electron beam generator releases an electron beam that is incident upon a location on the die surface (also see lines 1-12 of column 17 of US 6583634) **at an angle of at least 75°** is obvious modification to the apparatus of Macdonald to obtain maximum secondary electron beam [peaks 80, 82 of fig. 3a] to test the die or semiconductor device, since Macdonald also obtains maximum voltage contrast [fig. 3-6, particularly 4] for his apparatus as applicants.

Weiner et al. (hereafter Weiner) and Lin et al. (hereafter Lin) also discloses detecting defects in die or test structure using voltage contrast method and apparatus as Macdonald. Weiner and Lin discloses voltage contrast of secondary electrons from die or test structure and are more specific to comparison between darkness and brightness with defects detection such as open and short within die or test structure.

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to combine apparatus and method as taught by Weiner and Lin with apparatus and method as taught by Macdonald, so defects in the die can be detected.

Regarding claim 14, Macdonald discloses the apparatus of claim 13, wherein the secondary electron collector [lines 3-7 of column 5] is arranged to measure a secondary electron current at the location bombarded by the primary electron beam and the magnitude of the secondary electron current is a function of a local electrical field [lines 75 of column 4 and line 1 of column 5] near the location [see 22 and 22 in fig. 1].

Regarding claims 1 and 9, Macdonald discloses a method for measuring passive voltage contrast on a die, comprising:

providing a sample holder [16], the sample holder having a base and a supporting surface [for specimen or die];

attaching a die [specimen] to the supporting surface of the sample holder, the die having a first surface [surface where primary beams bombard] hosting a circuit and a second surface [surface where 16 is attached] that is in contact with the supporting surface of the sample holder;

scanning the first surface [using 10 and 21] of the die using a primary electron beam [21], the primary electron beam being incident on the first surface at a first angle [at about 45°] and generating a passive voltage contrast on the first surface [lines 22-25 of column 1].

Macdonald is silent about increasing the incident angle from the first angle to a second angle (above 75° for claim 9) at which the passive voltage contrast is maximized. However, Macdonald discloses angle of about 45° between the die and the primary beam [see lines 25-28 of column 1] to excite an emission of secondary electrons. Macdonald also suggests that secondary electron current produced by the primary beam varies with number of factors including die [specimen] geometry.

Adjusting the supporting surface of the sample holder to increase the incident angle from the first angle to a second angle at which the passive voltage contrast is maximized is obvious because moving the specimen or die as defined at lines 1-5 of column 8 requires adjustment of holder 16 and to shift secondary electron peak 80 or

82, so the surface of specimen or die can be study by measuring the potential of the surface, to obtain peak 82 or 80 of secondary electron, see lines 71-75 of column 7 and fig. 3.

Therefore, adjusting the angle (also see lines 1-12 of column 17 of US 6583634) as claimed is obvious modification to the apparatus of Macdonald to obtain maximum secondary electron beam (peaks 80, 82 of fig. 3a) to test the die or semiconductor device, since Macdonald also obtains maximum voltage contrast [fig. 3-6, particularly 4] for his apparatus as applicants.

Weiner et al. (hereafter Weiner) and Lin et al. (hereafter Lin) also discloses detecting defects in die or test structure using voltage contrast method and apparatus as Macdonald. Weiner and Lin discloses voltage contrast of secondary electrons from die or test structure and are more specific to comparison between darkness and brightness with defects detection such as open and short within die or test structure.

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to combine apparatus and method as taught by Weiner and Lin with apparatus and method as taught by Macdonald, so defects in the die can be detected.

Regarding claim 2, Macdonald discloses the method of claim 1, further comprising generating an image [fig. 4] of the circuit when the passive voltage contrast is maximized, different portions of the image having different brightness [84, 86 and 88] corresponding to different passive voltages [voltages of 84, 86 and 88] on the first surface of the die.

Regarding claim 3, Lin discloses the method of claim 2, further comprising examining the portions of the image having an abnormal brightness to identify electrical failures in the die [see claim 1].

Regarding claim 4, Macdonald discloses the method of claim 29 wherein the die is electrically connected to the ground through the sample holder [see fig. 1].

Regarding claim 5, Macdonald discloses the method of claim 4, wherein the circuit comprises at least a plurality of electrical components [gate and drain of transistor as shown in image of fig. 4] of a same type and one component whose brightness in the image is significantly different from that of others **may be** a defective component.

Regarding claim 6, Weiner discloses the method of claim 5, wherein there is an **electrical shorting failure** at the defective component if its brightness is higher then that of others in the image [see claim 7].

Regarding claim 7, Weiner discloses the method of claim 6, wherein there is an **electrical open failure** at the defective component if its brightness is lower than that of others in the image [see claim 7].

Regarding claim 8, Macdonald discloses the method of claim 1, wherein the second angle at which the passive voltage contrast is maximized is a function of the surface texture and surface composition of the die [lines 21-30 of column 1].

Regarding claims 10-11, Macdonald discloses the method of claim 1, wherein the primary electron beam has an accelerating energy level of 1-5 KeV and 2 KeV [1-30KeV, see lines 20-23 of column 8].

Regarding claim 12, Macdonald discloses the method of claim 1, wherein the primary electron beam is generated by a scanning electron microscope [see Abstract].

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Ellisman et al. (US 5414261) discloses taking the images while tilting the specimen at many different angles.

Lo et al. (US 6344750) discloses selecting parameters for maximizing voltage contrast.

Talbot et al. (US 6252412) discloses acquiring the images of the sample using beam angle up to 15° from normal during inspection of wafer.

Nozoe et al. (US 6583634) at lines 1-12 of column 17 discloses generation of secondary electrons depends on the angle between the primary beam and the solid surface.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Paresh Patel whose telephone number is 572-272-1968. The examiner can normally be reached on 8:00 to 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nestor Ramirez can be reached on 571-272-2034. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Paresh Patel
March 06, 2005